DR. LEVY'S PAPER ON MILK SUPPLY OF CITY OF RICHMOND

City Bacteriologist Makes Many Experiments Which Convince Him of Effect on City's Unusual Infant Mortality.

REMEDY NOT DIFFICULT; PROMPT ACTION NEEDED

Dr. Levy Suggests Plan for City to Control Its Milk Situation, But Highest Standard Cannot Be Demanded at Once; Dairies Must Be Inspected by Expert and His Decisions Promptly Enforced.

The next issue of the Old Dominion Journal of Medicine and Surgery, which has been delayed on account of the printers' strike, will contain a paper by Dr. Ernest C. Levy, city bacteriologist, on "The Milk Supply of Richmond From a Sanitary Standpoint—A Preliminary Study." This paper was read before the Richmond Academy of Medicine and Surgery on the 28th of last November.

During the past summer Dr. Levy made a study of the milk supply of Richmond from a sanitary standpoint, and his results and conclusions are set forth at some length in the article referred to. Realizing the timeliness of this paper, The Times-Dispatch obtained advanced sheets of the Old Dominion Journal of Medicine and Surgery, through the courtesy of its editor, Dr. Greer Baughman.

The article is too long to reproduce in its entirety in these columns, hence only those parts are selected which will be of special interest to the general public.

Appreciating the importance of a proper milk supply and believing that Dr. Levy might have some additional matters of importance to communicate on the subject, a Times-Dispatch reporter called on him at his laboratory in the City Hall.

"Do you believe, doctor," began the newspaper man, "that milk is responsible for much of the illness in Richmond?"

"There is absolutely no doubt that this is so," replied Dr. Levy. "Bad milk is the cause of a large proportion of all cases of intestinal trouble among bottle-fed infants, especially during the summer months. It has been shown over and over by the most positive demonstration that the mortality among infants who are artificially fed is enormously higher than among those who nurse, and it has been further proved that this is due almost entirely to what we speak of as 'dirty' milk.

"Much is Dirty."

"My investigation of last summer showed that much of the milk on the Richmond market comes under this head, and the infant mortality here speaks for itself. I found the city dairies themselves clean and well conducted, but they are largely dependent upon milk, which is brought in to them from a number of farms, and my examinations proved that conditions at many of these must be very bad."

"Coming to the practical question, how can this evil be corrected?" asked the reporter.

"That is a matter to which I have given a good deal of thought," replied the doctor. "The remedy is not difficult, but it requires prompt action if we are to accomplish anything during the coming summer. I have already recommended to the Board of Health and also to the Special Investigating Committee certain measures which, if carried out, would at once accomplish a great deal, but I am afraid that, with the inevitable delays in securing action, nothing will be done to improve conditions this summer.

"It is really very sad that this should be so, as prompt action now would probably mean the saving of many infant lives which would otherwise be needlessly sacrificed.

"I have told the Board of Health and the Investigating Committee that if I were given even one assistant I could manage to supervise this matter. Such a man would make regular inspection of the farms where milk is produced to be sold in the city and he would also, under me, do the necessary bacteriological work. Of course it would be necessary to clothe someone with sufficient power to exclude from this market all milk which came from dirty farms.

"The educational side of the case would have to be well looked after. As stated in the paper which I read before the Richmond Academy of Medicine last November, many farmers regard all talk about the necessity of cleanliness and cooling the milk, as being little more than a fashionable fad of the day. If they can be shown that these factors mean actual saving or sacrifice of life, most of them will try and do better, and those who will not should be denied the right to sell their milk in Richmond.

Certified Milk.

"The important question arises whether the handling of milk in such a manner as to make it safe—that is, simply cleanliness and prompt cooling—would involve so much additional cost as to make it impossible for the dairies to sell milk at the same price as they now do. Prof. Sedgwick, whose talk so delighted all those who had the privilege of hearing him a few weeks go, has long preached the doctrine of 'ten cent milk,' believing that the expense of cleanliness and other necessary protective measures makes it impossible to furnish sanitary milk for less.

"Whereas, the entire milk supply of the city should be under such sanitary supervision, besides this it would be possible for a few dairies, which are already specially arranged for producing milk under good conditions, to put on the market what is known as 'certified milk,' that is milk from farms which are regularly inspected and which are practically under the direction, so far as their sanitary control is concerned, of a competent expert in this kind of work, who would make frequent inspections of the farms, give instructions in the minutest details and check the results by regular bacteriological examinations of the milk. He could then 'certify' that such milk was all that could be desired from a sanitary standpoint.

"Such 'certified milk' naturally commands a higher price than milk gotten under less rigid supervision as a great deal of additional expense is involved. I would say that on the Richmond market it ought to bring not less than twelve cents a quart, but it would be well worth it.

Specially for Infants.

"As you probably know, one of the greatest institutions in New York City is the Strauss Milk Depots, where milk of unquestioned purity is furnished for infant feeding. I can conceive of no greater opportunity for some public-spirited citizen of Richmond to do good than by the establishment of such an institution in Ricamond, for it would mean the actual saving of many lives which are now sacrificed every year.

"In all of these ways there is a great work to be done. My chief regret in the whole matter is that I see no way by which the work can be started in time to do good this summer, and it is really a sad thing to reflect that many infants will surely die this summer in Richmond whose lives could be saved by the expenditure of a very small sum of money in looking after our milk supply. Personally, I would be very glad, as city bacteriologist, to supervise this work if only I could secure the funds to meet the actual expenses. Of course, it would be necessary to get certain ordinances passed to back up what was done. It would accomplish nothing merely to find out which farms furnished good and which bad milk, unless the bad milk could be excluded, but I imagine that if the City Council could be assured that the expense would not fall on the city itself, there would be no trouble in getting them to pass such ordinances without delay."

Dr. Levy's paper is, in part, as follows:

Milk is the most important single article of diet. It contains, in a readily assimilable form, all the necessary constituents of a complete food. But its chief claim to importance is that it is properly the sole article of diet of many infants during a considerable part of their existence. It is also food especially adapted for invalids.

No argument is needed, therefore, to show the importance of furnishing milk of good quality, and, since the individual consumer in cities has no means of knowing anything concerning the sanitary quality of the milk sold, it is properly held to be one of the functions of health boards to see that the public milk supply is kept up to the standard.

How It May Be Poor.

There are two general ways in which milk may depart from the requirements demanded of it: First, it may be deficient in nutritive value, either on account of its having been skimmed or watered, or, at times, on account of the fact that certain breeds of cows (notably Holsteins) furnish a milk of poorer quality than others. Second, a milk may be unfit for use from a sanitary standpoint on account of (a) having come from a diseased cow, or, (b) having been handled in a dirty manner, or, (c) having been kept too long at too high a temperature.

In a broad way, the tests applied to milk are for the purpose of detecting either one or both of these classes of departure from what constitutes a satisfactory, wholesome milk. Again, it may be necessary to examine for the presence of preservatives.

Regarding tests for the determination whether a milk is up to the standard of nutritive value, this can scarcely be called strictly a sanitary measure, since, for example, if a milk contains 11 per cent. of solids instead of the required 12 per cent., this, of itself, simply means that it would take twelve pints of this milk to contain the nutriment that should be eleven pints, or, to state the same proposition in different terms, it means that the purchaser is getting eight cents' worth less of food value in each dollar's worth of milk than he is entitled to receive.

At first glance, therefore, it might seem questionable whether regulations as to the food value of milk properly fall within the domain of public health departments. But the custom of all our most advanced communities is in this direction, hence the wisdom of such regulations might as well be admitted without argument.

A more rational plea than mere custom, however, lies in the fact that any regulation which demands regular supervision of the conditions under which milk is produced will, if intelligently applied, lead to beneficial results. When a farmer, or a city dairy, has to live up to requirements of one kind, there is a tendency to improve conditions along other lines.

The very regulation in question, by setting a standard of nutritive value, probably causes the producers to pay more attention to the condition of their stock, and to many other matters which are beneficial in a sanitary direction.

Regarding the second manner of departure of milk from the proper standard, no such indirect mode of argument is needed to show its importance. We will leave out of consideration in this report the entire question of milk from diseased cows, confining our attention to what has come to be described nowadays as "dirty" milk.

Caused By Improper Milk.

It is universally admitted that a very large proportion of all cases of intestinal disorders among infants (whether called by the name "summer complaint," "infantile diarrhea," "cholera infantum," or what not) is caused directly by improper milk. The terrors of the "second summer" of infants are due, not to any peculiarity of that period of life, but to the fact that most infants are weaned by that time, and are on a diet made up largely of cow's milk, and the trouble is occasioned by bacteria which have either developed poisonous substances by their growth in the milk before it is swallowed, or which work their harm by multiplying after reaching the stomach.

Although it is practically impossible to secure milk absolutely free from bacteria, still there is no reason why, if proper care is exercised, it should not be certain to contain no harmful bacteria and a much smaller proportion of harmless ones than is commonly the case.

Rigid inspection of all farms where milk is produced to be sold in cities is the first essential. Diseased cows are naturally a source of danger, but plain, simple dirt is a far greater one. Cleanliness about the stable, washing the udder and right side of the cow and then drying them before milking, clean hands and clean garments for the milkers and clean pails for the milk, are among the most important means for preventing recess of bacteria to the milk.

But keeping bacteria from entering the milk is only half the battle. In warm milk a few bacteria may, in the course of a very short time, increase to thousands or even millions, hence the second requirement is to cool the milk at once and keep it at as low a temperature as possible until it is used.

Measures looking to the sanitary quality of milk are therefore of immensely greater value than those which aim merely at furnishing milk which is up to the standard from a nutritive standpoint. In order to secure milk fulfilling the sanitary requirements—or "clean" milk, as it is now commonly called—inspection and control of the conditions under which it is produced are essential.

Education of the managers of the farms and dairies is another essential; for few farmers have the faintest conception of their responsibility in this matter, and most of them regard the points above mentioned as little more than a fashionable fad of the day.

Regarding what may be accomplished by ordinances dealing with this question, certain cities have requirements as to the temperature at which milk must be furnished, and some few of them have a standard of bacterial content. The Boston law, for example, demands that no milk shall be brought into the city for sale, or be offered for sale, the temperature of which is above 50 degrees Fahr., or which contains over 500,000 bacteria to the cubic centimeter (about 16 drops). Milk produced under good conditions should fall far short of anything like this number of bacteria.

Regarding the significance of bacteria in milk, it must be distinctly recognized that the question of the kind of bacteria present is of far greater importance than their mere number. In the present stage of our knowledge, however, we have no method of detecting in a milk the varieties of bacteria the presence of which we believe to be the chief menace, namely; typhoid bacilli and the germs of intestinal diseases. Tubercle bacilli can be satisfactorily demonstrated only by the means of tedious animal experiments. Direct microscopic examination for the detection of pus cells and one form of pus-producing bacteria (streptococcus) is a field now being investigated with a fair promise of good results.

Valuable Safeguard.

Routine determinations of the bacterial content of milk is, therefore, an exceedingly valuable safeguard to its sanitary quality, but only if the results obtained are used as a basis of following up the cases by an investigation of the causes which have given rise to the high counts, and then seeing to their correction.

It was for the purpose of ascertaining something of the general sanitary quality of the milk sold in Richmond during the months when intestinal disorders among infants are especially prevalent that the preliminary investigation here reported was undertaken. The writer was employed to do this by Mr. John P. Branch, of this city.

In making this preliminary test of the milk of Richmond from a bacteriological standpoint, a number of samples (33) were first collected from various places where milk is sold at retail, either by the glass, for immediate consumption (restaurants, soda fountains, etc.), or in small quantities for home use. It was, of course, expected that this series of samples would show the presence of far more bacteria than the samples collected directly from the milk wagons and dairies, on account of the longer time it had been kept.

With determinations made by counting the colonies which developed on lactose agar-plates kept at body temperature, the best milk in this series (excluding one sample taken from a private residence) contained 70,000 bacteria per cubic centimeter, while the worst contained 25,000,000, with an average of 3,760,000. With plates, which were allowed to develop at room temperature, the counts were much higher, the lowest being 230,000 and the highest 75,000,000. The method of incubating plates at body temperature is that adopted in Boston, where a bacteriological standard of not over 500,000 is in force. Applying this standard to our series of tests only 45 per cent. of this milk would have been allowed to be offered for sale. The contrast between the samples which, according to the dealers' statement, had been received the same day and those which had been on hand from the day before is marked in almost every instance, though some of the results lead to the conclusion that milk received the previous day was passed off as having been recently received, a course most natural where the mere selling of a glass of milk was in view, but one which reacted in an unlooked for manner when this glassful of milk was taken for a test of the quality of the milk sold by the dealer.

The chief claim of bacteriology in connection with tests of milk is that it enables us, by means of systematic examinations, to learn a great deal about the sanitary conditions at the place where it is produced, to make intelligent recommendations in cases calling for them, and to know, even without actual inspection of the premises thereafter, whether these recommendations are being faithfully followed. Mere examination of milk bacteriologically is, of course, valueless unless there is, in connection with it, systematic inspection of the method of handling the milk, backed by sufficient power to enforce proper sanitary measures, and this, in turn, backed by the necessary knowledge as to what should be done.

Table V., showing contrast between milk obtained from the same cow before and after washing udder of cow and hands of milker, and showing also effect of keeping milk cool. Experiment conducted August 16-18, 1906. The numbers given are bacteria per c. c.:

TABLE 5.

No. of hours after milking.	Udder of cow and hands of milker washed.	Udder of cow and hands of milker not washed.
0.....	300	11,000

	Milk Cooled and kept in refrigerator	Milk kept at room temperature	Milk Cooled and kept in refrigerator	Milk kept at room temperature
14..	7,000	30,000	30,000	730,000
19.... ..	8,000	1,500,000	20,000	6,500,000
43.. 200,000		330,000,000	1,100,000	1,600,000,000

In order to present actual evidence of the effect of cleanliness and low temperature in furnishing sanitary milk, the experiment shown in table V. was conducted. On the afternoon of August 16th, I visited a dairy farm near Richmond, reaching there as the cows were coming in from pasture. Through the courtesy of the proprietor I was allowed to collect a sample from a cow exactly as she came in, without washing either the udder of the cow or the hands of the milker. A second sample was collected from the same cow after washing the udder and after the hands of the milker had also been washed. Two bottles were collected under each of these conditions, one of each set being rapidly cooled, and kept cool in the refrigerator, while the other pair of bottles was kept at room temperature, without any cooling.

As the milk came from the cow, the clean sample had only 300 bacteria per cubic centimeter, while the one collected without any precautions had 11,000.

Further determinations were made after fourteen, nineteen and forty-three hours. The results are shown in the table. From this experiment it is evident that the milk which was carefully collected and kept cold was far better at the end of nearly two days than the average sample taken from the wagons about town, having only 200,000 bacteria per c. c. at the end of forty-three hours, while, at the other extreme, the sample which was not clean at the start and which was not kept cold had the enormous number of 1,000,000,000 (one billion) bacteria per c. c. after the same interval. This sample passed the limit of the Boston standard after only fourteen hours, having at that time 730,000. The difference in the keeping quality between clean, cold milk and unclean, warm milk is forcibly demonstrated in this experiment.

Conclusions.

1. The average bacterial content of milk found on the Richmond market during the summer months is entirely too high, when the nearness of the producers to the consumer is taken into acount.

2. Although it was not attempted in this preliminary investigation to determine the relative importance of lack of cleanliness and keeping the milk at too high a temperature as factors in bringing about this result, it may be confidently stated that each is in a measure responsible.

3. That mere temperature could not be the sole factor is shown by the fact that some of the warmest samples gave comparatively low counts in spite of the fact that as long a time had elapsed after milking as with other samples which were cooler, but which gave very high counts.

4. On the other hand, throughout this investigation it was evident that sufficient attention is not paid to cooling the milk and keeping it cool. Improvement in this respect would of itself be productive of much good, but low temperature is no substitute for original cleanliness, in spite of the fact that we have no means at present of distinguishing bacteriologically between a clean milk which has been kept too long at two high a temperature and one which was dirty at the start but which has been kept a shorter time and at a lower temperature.

Get It By Degrees.

5. Regarding the establishment of a bacteriological standard for milk in Richmond, it would be most unwise to do so arbitrarily until the proper standard had been worked out by a careful study extending over a year. To adopt the Boston standard, for instance, would be a mistake, without preliminary investigation; for, on the one hand, the higher temperature of Richmond tends to favor the multiplication of bacteria (though if the milk is promptly cooled, artificially, this factor would not seem to be of much importance), while, on the other hand, the nearness of the producers should certainly act in the opposite direction. The relative value of these opposing factors can be ascertained only by a series of experiments covering all seasons of the year.

6. Such a study of the situation would be immediately productive of beneficial results, even before the actual adoption of a bacteriological standard, since the dairies are anxious to co-operate in such work, and as soon as they learned which of the farmers were furnishing proper and which improper milk, the latter should be required to do better or else be dropped.

7. If thought advisable, regular weekly statements could be issued, showing the sanitary quality of the milk furnished by the dairies, and the rivalry thus excited would keep them all up in their efforts to improve conditions by getting back at the producers.

8. An important and absolutely necessary part of the investigation would be inspection of the farms and of all the conditions under which the milk was produced, since this would be required in order to establish the correlation between the bacteriological findings and the sanitary conditions, and thereafter similar bacteriological findings could confidently be referred to similar conditions and the latter be at once investigated.

9. To carry out this work would demand at least one man to devote his time exclusively to inspection of the farms and dairies and to the bacteriological examination of the milk.

10. This should be commenced during the winter months, in order that everything might be in running order before the danger period of the summer; and, properly organized and carried out, this work would unquestionably result in the saving of many lives and more illness and suffering.

11. Finally, the efficiency of the work would be greatly increased after it became possible to establish a reasonable bacteriological standard and see that violations of it were strictly dealt with.

TABLE I.

SHOWING THE NUMBER OF BACTERIA PER CUBIC CENTIMETER IN SAMPLES OF MILK COLLECTED FROM SODA FOUNTAINS, RESTAURANTS, SMALL DEALERS, Etc.

No. of Sample.	Collected from.	When Collected. Date. 1905.	Time.	When Received by Dealer.	Supplied by Dairy.	Temp. of Sample. Fahr.	Bacteria per c. c. Develop'g at Body Temp.	Develop'g at Room Temp.
1	2 R	July 25	10:00	Day before	1	60	6,500,000	16,000,000
2	1 F	July 25	10:05	Day before	1	62	5,500,000	10,000,000
3	2 R	July 25	10:10	Day before	1	53	35,000,000	53,000,000
4	2 R	July 25	10:15	Just received ..	1	56	640,000	5,200,000
5	2 F	July 25	10:20	Just received ..	2	60	70,000	250,000
6	2 R	July 25	10:25	Same day	2	61	100,000	240,000
7	1 F	July 26	9:05	Same day	1	59	750,000	2,000,000
8	1 F	July 26	9:10	Same day	1	55	2,700,000	6,000,000
9	2 R	July 26	9:15	Just received ..	2	49	220,000	400,000
10	2 R	July 26	9:45	9:30 A. M.....	3	72	190,000	230,000
11	2 F	July 27	10:25	Day before	1	60	6,500,000	21,000,000
12	2 F	July 27	10:30	Day, 4 P. M....	3	55	450,000	600,000
13	3 G	July 27	10:40	Same day	4	72	8,500,000	22,000,000
14	2 G	July 27	10:45	Same day	2	57	160,000	300,000
15	3 G	July 27	10:50	Same day	1	62	1,100,000	2,000,000
16	2 F	Aug. 10	8:45	8:40 A. M.....	1	61	180,000	340,000
17	1 F	Aug. 10	8:55	7:00 A. M.....	1	57	8,300,000	70,000,000
18	1 F	Aug. 10	9:10	7:45 A. M.....	5	67	140,000	900,000
19	4 G	Aug. 10	9:35	7:00 A. M.....	1	65	650,000	6,000,000
20	2 F	Aug. 10	10:00	5:30 A. M.....	1	56	350,000	5,500,000
21	2 F	Aug. 10	10:10	9:00 A. M.....	1	52	3,500,000	10,000,000
22	2 F	Aug. 11	9:45	9:00 A. M.....	1	47	200,000	1,100,000
23	1 F	Aug. 11	9:50	8:45 A. M.....	1	66	420,000	800,000
24	2 F	Aug. 11	10:00	Aug. 10, 4 P. M.	1	59	700,000	2,100,000
25	1 F	Aug. 11	10:05	Aug. 10, 6 P. M.	1	63	5,600,000	9,000,000
26	2 G	Aug. 11	10:10	7:00 A. M.....	2	66	800,000	800,000
27	2 R	Aug. 11	10:30	7:00 A. M.....	6	69	900,000	1,000,000
28	2 F	Aug. 12	10:30	7 A. M.....	1	46	400,000	3,000,000
33	4 G	Aug. 14	9:15	7 A. M.....	(?)	70	36,000,000	75,000,000
34	3 G	Aug. 14	9:30	7:30 A. M.....	2	61	370,000	750,000
35	3 G	Aug. 14	9:45	7:30 A. M.....	7	75	550,000	800,000
36	Res.	Aug. 14	10:00	7:30 A. M.....	1	75	60,000	330,000
37	3 G	Aug. 14	10:40	7:00 A. M.....	1	55	500,000	800,000

R—Restaurant. F—Soda fountain. G—Grocery.

The numerals indicate the grade of dairy, 1 being first-class in every respect; 2, good but not strictly high class; 3, rather poor, not perfectly clean; 4, decidedly bad; 5, extremely bad. Under 2 are included many places entirely satisfactory as regards cleanliness, but not first-class in appointments.

The dairies are designated by numbers, and a key to these accompanied this report. It was thought best, however, not to publish the names at this time.

Sample 9 had ice in the can with the milk.

Sample 36 was collected from a private residence, from regular family supply.

TABLE II.

SHOWING THE NUMBER OF BACTERIA PER CUBIC CENTIMETER IN SAMPLES OF MILK COLLECTED FROM DELIVERY WAGONS.

No. of Sample.	When Collected. Date. 1905.	Time.	Dairy No.*	Time of Leaving Dairy.	Temp. of Sample. Fahr.	Bacteria per c. c. Develop'g at Body Temp.	Develop'g at Room Temp.
29	Aug. 12	10:20 A. M.	2	10:10 A. M.	57	320,000	440,000
30	Aug. 12	10:55 A. M.	1	10:45 A. M.	54	200,000	400,000
31	Aug. 12	10:45 A. M.	2	9:00 A. M.	58	320,000	480,000
32	Aug. 14	9:10 A. M.	1	8:30 A. M.	53	120,000	120,000
38	Aug. 15	8:45 A. M.	1	8:30 A. M.	50	160,000	400,000
39	Aug. 15	8:50 A. M.	8	8:15 A. M.	79	380,000	500,000
40	Aug. 15	9:20 A. M.	9	6:00 A. M.	80**	250,000	2,000,000
41	Aug. 15	9:20 A. M.	2	9:00 A. M.	55	550,000	750,000
42	Aug. 15	9:30 A. M.	1	9:20 A. M.	47	270,000	350,000
43	Aug. 15	9:50 A. M.	2	9:45 A. M.	59	610,000	630,000

* See foot-note to Table I.

** Sample collected from a producer, just in from the country.

TABLE III.

SHOWING THE NUMBER OF BACTERIA PER CUBIC CENTIMETER IN MILK AS RECEIVED AT THE DAIRIES. SAMPLES COLLECTED FROM CANS BROUGHT IN BY THE PRODUCERS.

No. of Sample.	Dairy No.*	When Collected. Date. 1905.	Time.	Time of Finishing Milking.	Temp. of Sample. Fahr.	Bacteria per c. c. Develop'g at Body Temp.	Develop'g at Room Temp.
44	2	Aug. 16	9:00 A. M.	5:30 A. M.	81	600,000	700,000
45	2	Aug. 16	9:00 A. M.	7:00 A. M.	85	110,000	350,000
46	2	Aug. 16	9:00 A. M.	5:30 A. M.	56**	100,000	240,000
47	2	Aug. 16	9:00 A. M.	7:30 A. M.	82	10,000	20,000
48	2	Aug. 16	9:00 A. M.	7:30 A. M.	95	180,000	900,000
49†	2	Aug. 16	9:00 A. M.	.....	56	110,000	220,000
52	1	Sept. 9	9:30 A. M.	8:00 A. M.	77	300,000	500,000
53	1	Sept. 9	9:30 A. M.	8:30 A. M.	76	30,000	30,000
54	1	Sept. 9	9:30 A. M.	8th, 6 P. M.	67	15,000,000	43,000,000
55	1	Sept. 9	9:30 A. M.	8:30 A. M.	76	110,000	170,000
56	1	Sept. 9	9:30 A. M.	7:00 A. M.	72	350,000	800,000
57	1	Sept. 13	9:00 A. M.	7:00 A. M.	73	30,000	40,000
58	1	Sept. 13	9:00 A. M.	7:00 A. M.	79	80,000	220,000
59	1	Sept. 13	9:00 A. M.	7:00 A. M.	78	2,500,000	5,200,000
60	1	Sept. 13	9:00 A. M.	7:00 A. M.	76	180,000	180,000

* See foot-note to Table I.

** This sample had been over aerator.

†No. 49 was a mixed sample of 44, 45, 47 and 48, after passing over aerator.

TABLE IV.

GIVING THE AVERAGES OF TABLES I., II. AND III., AND SHOWING THE ACTUAL NUMBER OF SAMPLES AND THE PERCENTAGES OF SAMPLES WHICH WERE UP TO THE BOSTON STANDARD.

	Average No. of Bacteria per c. c. Developing at Body Temp.	Developing at Room Temp.	No. of Samples.	Passing Boston Standard—Actual Number— at Body Temp.	at Room Temp.	P. C. at Body Temp.	P. C. at Room Temp.
Table I.	3,700,000	9,900,000	33	15	7	45	21
Table II.	320,000	610,000	10	8	7	80	70
Table III.	1,300,000	3,500,000	15	12	10	80	67
Table III., with Sample 54 eliminated	330,000	680,000	14	12	10	86	72
Table III., with Nos. 54 and 59 eliminated	160,000	340,000	13	12	10	92	77